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Test Shipments of Elberta Peaches From South Carolina to New York - 1948.

(Unaccompanied shipments comparing types of baskets and degree of ventilation in baskets.)

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TEST SHIPMENTS OF ELBERTA PEACHES FROM SOUTH CAROLINA TO NEW YORK - 1948

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The bushel export tub basket has been and is the principal container used for shipping peaches from the eastern and central peach growing areas of the United States. It constitutes an economical package for the bulk shipment of the fruit. However, its continued use with such a tender and perishable fruit as the peach has been questioned on the grounds that the container is not ventilated sufficiently to permit rapid cooling of the fruit and that it does not adequately protect the fruit from bruising.

Shipping tests were made during the 1948 Elberta peach season from the Spartanburg, South Carolina section to obtain information relative to the effect of type of package and degree of ventilation in bushel baskets on cooling of the fruit in transit and bruising of the fruit on arrival at destination and when ripened. A test with 8 cars that were accompanied by observers has been issued under the designation "A.A.R. - U.S.D.A. Test No. 29". The present report deals with 3 unaccompanied tests comprising 3 cars each in which temperature records were obtained by means of recording thermometers. The treatmentsin these tests are outlined in Table 1. All cars in any one test were shipped under the same type of refrigeration usually preiced and standard refrigeration plus 5 percent salt.

Sample packages of peaches selected for more advanced degrees of ripeness were placed at the top and bottom quarterlength positions for examination at destination. Ryan recording thermometers were placed in the center of packages at the same positions as the sample packages.

Table 1. Cars Used In Unaccompanied Shipments And Package Comparisons Made.

Test No.	Car No.	Loaded At	Date Loaded	Container [1]
1	MDT 19807	Gramling, S.C.	7/21/48	Bu. basket - Standard
1	WFE 61008	" " "	"	" " - Extended stave
1	FGE 35877	" " "	"	Half bu. basket - Standard
2	FGE 10969	Inman, S. C.	7/27/48	Bu. basket - Std. pad (not vented)
2	FGE 11208	" " "	"	" " - Perforated pad
2	FGE 36346	" " "	"	" " - Slotted pad
3	FGE 38512 [2]	" " "	7/29/48	Bu. basket - Std. pad (not vented)
3	WFE 66743 [2]	" " "	"	" " - Perforated pad
3	WFE 66917 [2]	" " "	"	" " - Slotted pad

1/ See text for detailed description of containers.

2/ Fan cars, all others non-fan cars. After loading it was found that the fans in one end of each of 2 cars were out of order. Because of this and in order to make all of the cars comparable only one fan was used in the third car also.

Description of Containers and Pads

Standard Bushel Basket:

The standard export tub basket used in the tests was made with 12 staves. Ventilation was provided by spaces of about 3/8" between the staves and a 5/8" hole in the center of the bottom. A slotted liner was used with this basket. The net space available for ventilation through the sides would be the space in which the liner openings coincide with the openings between the staves. Usually 2 of the liner openings coincide with each of the openings between the staves. As these spaces were about 3/8" square there was a total area of about 3.4 square inches available for ventilation around the sides. A crown type lid and standard cushion type pad was used except as otherwise noted.

Standard Half Bushel Basket:

The half bushel basket was similar in construction to the standard bushel basket except for size It was made with 10 staves instead of 12 with spaces of about 3/8" between them. Similar type liners, cushions and lids were used as for the bushel baskets.

Extended Stave Basket:

The extended stave basket was similar to the standard bushel basket except that the staves extended about 7/8" above the top band or hoop. (As shown in figure 1.) The lid for this basket was flat and without the rim or band around the under side of the edge. The elimination of the rim on the lid and the extension of the sides were intended to eliminate rim cuts. The basket was packed with a bulge and standard cushions and slotted liners were used.

Standard Pad:

The standard pads were of the cushion type filled with confettied paper.

Perforated Pad:

Ventilated pads were used to obtain some ventilation through the top. The perforated pad was made of double faced corrugated paper with 48 holes 1/2" in diameter distributed in a radius of 2 to 7 inches from the center of the pad as shown in figures 2 and 3. This pad extended slightly beyond the rim of the lid to protect the fruit from rim cuts and was stapled to the center of the lid to hold it in place. As will be seen from figure 3 not many of the perforations in the pad coincided with the lid openings. When used it was observed that there was seldom more and frequently less than 4 or 5 perforations that were available for ventilation and some of these would be closed by peaches centering under them and closing them. With the perforated pad the total area open for ventilation was usually less than 1.5 square inches and probably never more than 2 square inches.

Slotted Pads:

In order to obtain the maximum possible ventilation through the top, slots were cut in pads to correspond in size and position with the openings in the lids as shown in figures 2 and 3. These pads were stapled to the lids so that the slots in the pads coincided with the lid openings. Each lid opening was about 3/4 x 4 inches for a total possible area of 18 square inches of opening. The slots in the pads were slightly narrower than those in the lids so that the area of opening was probably around 12 - 16 square inches.

Results

Test Shipment No. 1

This test shipment loaded at Gramling, South Carolina was a comparison of the standard bushel basket with the standard half bushel basket and a comparison of the standard bushel basket with the extended stave bushel basket (table 1). The cars were loaded on July 21 near the beginning of the harvest season when the fruit was relatively immature. Although the most mature peaches were sorted out (by color) for the test packages they were still firm and not subject to excessive bruising.

The temperatures recorded en route at the top and bottom quarterlength at the centerline are shown in figure 4. There was not any very consistent difference in fruit temperature due to the type of container used. Thus although the fruit cooled most rapidly in the standard bushel basket in the top layer position, fruit in this container cooled slowest in the bottom layer position. Similarly although the half bushel basket cooled slower than the extended stave basket in the top layer there was essentially no difference between these in the bottom layer.

In general, the results do not indicate that the rate of cooling can be increased by using the half bushel basket instead of the standard bushel basket. There seemed to be somewhat wider spaces between the staves of the extended stave basket than of the standard bushel basket but this larger opening for ventilation did not seem to facilitate cooling.

The principal benefit to be expected from using the half bushel basket would be a reduction in bruising from the smaller quantity of fruit in this container compared with a bushel basket. However, the use of half bushel baskets apparently did not consistently or significantly reduce either bruising damage or decay when compared with the use of bushel baskets. The results of inspections on arrival at destination and after ripening are given in table 2.

The principal benefit to be expected from using the extended stave basket would be a reduction in rim cutting of the face layer of fruit. Injury to the face layer fruit was noted separately. Only 3 damaged peaches were found in the face layers of all of the baskets and these were in the extended stave baskets. The results therefore do not indicate any benefit from the use of the extended stave basket. However, the data are very limited and much additional data would be necessary for conclusive results. Although decay averaged less in the extended stave basket the difference was not statistically different.

Test Shipment No. 2

These test shipments were loaded at Inman, South Carolina on July 27th and consisted of a comparison of different degrees of ventilation through the top of standard bushel baskets when shipped in non-fan cars (table 1). Test packages of relatively mature fruit were loaded into these cars to determine the protection afforded by the different type pads.

The primary interest in this test was in the rate of cooling as influenced by the amount of opening in the pads for ventilation. The temperature records taken from the thermograph charts are shown in figure 5. These results indicate that the rate of cooling increased as the degree of ventilation through the pad was increased, both in the top and bottom layers. However, the somewhat lower temperatures prevailing in the baskets with ventilated lids did not result in any significant reduction in decay or bruising damage (see table 3). In addition to the data in table 3, notes were made of injury to the face layer of fruit. A greater percentage of the fruit in the top of the face layers was flattened by the lid with corrugated paper pads (22.4 and 12.9 percent) than with the cushion pads (5.4 percent).

Test Shipment No. 3

This test was similar to test number 2 except that fan cars were used instead of non-fan cars, although as noted in table 1, only one fan was used on each car. The cars were loaded at Inman, South Carolina on July 29th (table 1). In cars A and C the test samples were located in the end of the car in which the fans were operating, whereas in car B (with perforated pads) the samples were located in the opposite end of the car from the one in which the fans were operating. This difference probably did not materially influence the results. In this test temperature records were obtained at 4 positions in each car, in the top, middle and bottom layers at the quarterlength position and the middle layer at the doorway position. The results for each position taken from the charts at intervals are shown in table 4 and the average of all 4 positions charted in figure 6. The fruit in the baskets with slotted liners was somewhat cooler at the start and maintained this difference for about 45 hours. However, the slope of the curves in figure 6 does not indicate that cooling was increased by increased ventilation in the pads.

The results of the inspections of the test packages are given in table 5. No consistent or significant difference in decay or bruising damage was found in fruit from the different cars. This was to be expected since the different degrees of ventilation in the pads did not result in appreciably more rapid cooling. In addition to the data in table 5, notes were made of the condition of the face layer of peaches in the test baskets. A greater percentage of the top side of the peaches of the face layer were more or less flattened by the lid when corrugated paper pads were used (10.7 and 10.6 percent) than when the cushion pads were used (4.1 percent). There was no difference in other types of bruising or damage.

Discussion:

These results are largely negative in that they do not show any appreciable reduction in bruising from the use of the smaller containers (1/2 bushel baskets compared with bushel baskets) or from the use of extended stave baskets compared with standard baskets. Likewise, they do not show any very appreciable or consistent increase in rate of cooling from increased ventilation through the top of the basket. These results are in agreement with those obtained in the test designated AAR - USDA Test No. 29, and confirm conclusions reached in that test, that in the standard peach load which is only 3 high, the rate of cooling even in the top layer is sufficiently rapid to give good carrying temperatures and therefore no great difference could be noted in rate of ripening or of decay, regardless of position in the load or of containers used.

Severe bruising of peaches when packed in baskets frequently comes from either the weight of the top fruit bruising and flattening the bottom layer fruit against the bottom of the container or from the pressure of the lid on the fruit of over-filled baskets. Bruising from weight becomes particularly apparent when the baskets are handled after the fruit has become somewhat ripe and soft. Bruising from this cause was relatively slight in Test No. 1 as the peaches were relatively immature and firm when packed and consequently the benefit from packing in half bushel baskets was not apparent. On the other hand, over-filling of the half bushel basket would probably be more serious than over filling of the bushel basket as the shorter distance between the top and the bottom would allow for less give to take up the excess pressure. There seemed to be a somewhat greater tendency to over fill the half bushel basket than the bushel basket which would tend to counterbalance the benefits that might otherwise come from using the smaller containers. Thorough racking as the baskets are filled and careful adjustment of the fill would probably do much to reduce bruising without resulting in slack packs in both bushel and half bushel baskets.

Although the results did not indicate any benefit from the use of the extended stave basket, they were not adequate to be at all conclusive.

Ventilation through the top increased the rate of cooling somewhat in the shipment with non-fan cars but not in the shipment with fan cars. Why it should be effective with the one and not the other is not apparent. Even in the non-fan cars the differences in temperature were not enough to produce any noticable difference in the ripeness or condition of the fruit. With the perforated pads the amount of opening available for air movement was less (about half) than that available through the sides and bottom and would be

the limiting factor to the vertical air movement through the basket. With the slotted pads the openings were much larger than those available through the sides and bottom and under these conditions the sides and bottom would limit air movement through the package. With slotted pads similar to those used, increased ventilation might be obtained by extra vented baskets in which the spaces between the staves are wider and in which slots are cut through the bottoms.

Earlier studies with vented pads indicated greater benefit in rate of cooling from the ventilation. However, the earlier results were not obtained in full carloads of each treatment and it seems likely that cooling of a few containers of one type would be influenced by the bulk of the load with containers of another kind, and this may account for the apparent difference in results.

Acknowledgements

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To Don Jemms of the Veneer Package Manufacturing Association and Raymond G. Ramsey of the American Package Corp. for suggestions and arranging for the different types of baskets. To George Talbot Jr. of the Inland Container Corp. for furnishing the perforated pads and material for the slotted pads. To Marion King of the Fruit Growers Express Co. who arranged for the cars used in the tests.

Table 2. Inspection of Elberta Peaches Shipped in Different Types of Containers [1]. South Carolina -1948- Test No. 1

Car	Type	Container No.	Position in car [2]	Total No. Fruit	Decay [3] A [4] %	Decay [3] B [4] %	Slight Bruise A %	Damage A [4] %	Damage B [4] %	Severe Damage A [4] %	Severe Damage B [4] %	Ripeness [5] A [4]	Ripeness [5] B [4]
A (FGT 35877)	Std. half bu. basket	1	TQL CL	58	1.7	5.1	12.6	6.9	13.8	0	0	F - R	FR - R
		2	" "	56	5.4	9.0	8.9	3.5	8.9	0	0	F - R	F - R
		3	BQL CL	56	1.8	1.8	5.3	1.8	1.8	7.2	3.6	H - F	FR [6]
		4	" "	56	7.2	14.5	3.6	0	1.8	1.8	1.8	H - F	R [6]
B (MOT 19807)	Std. bu. basket	1	TQL CL	111	0.9	14.4	8.1	7.2	6.3	3.6	3.6	F - R	R
		2	" "	107	6.5	9.3	5.6	5.6	3.7	4.6	5.6	F - R	R
		3	BQL CL	123	0	14.6	1.6	1.6	1.6	5.7	.8	H - F	FR - R
		4	" "	97	0	3.1	4.1	1.0	1.0	2.0	0	H - F	FR
C (WFE 61008)	Extended stave bu. basket	1	TQL CL	126	3.2	8.7	17.4	4.7	5.5	4.0	4.7	F - FR	R
		2	" "	112	3.6	5.3	21.4	1.8	0	0	0	F - R	R
		3	BQL CL	111	0	0	.9	.9	0	0	0	H - F	FR - R
		4	" "	118	.8	2.6	.9	0	0	3.4	0	H - F	FR - R

1/ Loaded at Gramling, S.C. on 7/21/48. Car A - 1:00-3:00 P.M.; Car B - 7:00-8:00 P.M.; and Car C - 3:00-5:00 P.M.
2/ T = Top; B = Bottom; QL = Quarterlength; CL = Centerline.
3/ Both brown rot and Rhizopus (67% brown rot and 33% Rhizopus).
4/ A = Arrival inspection 7/26/48. B= Final inspection 7/28/48.
5/ H = Hard, F = Firm, R = Ripe
6/ Not as ripe as peaches from top quarterlength position.

Table 3. Inspection of Elberta Peaches Shipped in Bushel Baskets with Different Degrees of Ventilation Through The Pads in Standard (non-fan) cars 1/. South Carolina -1948- Test No. 2

Car	Container 2/ Pad	No.	Position in car	Total No. Fruit	Decay 3/ A 4/ %	Decay 3/ B 4/ %	Slight Bruise A 4/ %	Damage A 4/ %	Damage B 4/ %	Severe Damage A 4/ %	Severe Damage B 4/ %	Ripeness 5/ A 4/	Ripeness 5/ B 4/
A FGE 10969	Std. (Non-vented)	1	TQL CL	153	0.7	13.8	2.0	4.6	5.2	2.0	3.3	F - R	R
		2	TQL CL	174	1.2	9.2	6.9	6.3	10.9	1.1	.6	F - R	F - R
		3	BQL CL	167	.6	3.0	6.0	2.4	3.0	1.2	1.2	F - R	FR- R
		4	BQL CL	163	0	4.9	4.3	3.7	4.3	3.7	2.5	F - R	R
B FGE 11208	Perforated	1	TQL CL	151	.7	3.3	4.6	6.0	5.3	2.0	2.0	F - R	R
		2	TQL CL	165	.6	4.8	3.0	2.4	3.6	1.2	1.2	F - R	FR - R
		3	BQL CL	165	0	1.8	9.7	0.6	3.0	0	0	F - R	FR - R
		4	BQL CL	154	0	3.2	1.3	3.9	2.6	0	1.3	F - R	FR - R
C FGE 36346	Slotted	1	TQL CL	162	2.5	10.5	4.9	4.9	1.2	.6	1.2	F - R	FR - R
		2	TQL CL	166	1.2	9.0	10.2	6.6	9.6	5.6	6.0	FR- R	R
		3	BQL CL	161	0	0	9.3	6.8	7.5	1.9	2.5	F - R	FR - R
		4	BQL CL	166	0.6	1.8	4.2	3.6	3.6	1.2	2.4	F - R	FR - R

1/ Loaded at Inman, S.C. on 7/27/48. Car A -3:00 to 4:30 P.M.; Car B -2:00 to 3:00 P.M.; Car C -4:30 to 6:00 P.M.
2/ Standard export tub bushel basket. For description of pads see text page 2 and figures 2 and 3.
3/ Both brown rot and Rhizopus (about 25% brown rot and 75% Rhizopus).
4/ A = Arrival inspection 7/31/48. B = Final inspection 8/2/48.
5/ F = Firm, FR = Firm ripe, R = Ripe.

Table 4. Temperature of Peaches During Transit as Influenced by Degree of Ventilation Through Pads. South Carolina, 1948 Test No. 3

Car No.	Ryan No.	Position CL	Temperature (°F.) At Start	2 hrs.	4 hrs.	6 hrs.	12 hrs.	24 hrs.	48 hrs.	72 hrs.	96 hrs.	120 hrs.
FGE - 38512 Std. Pads A	2117	TQL	78	78	77	75	71	53	44	41	40	39
	2076	MQL	80	76	74	71	62	52	43	39	37	37
	1400	BQL	80	68	62	59	51	45	40	34	34	34
	2107	MDW	78	77	75	74	67	55	45	40	37	36
		Ave.	79	75	72	69.5	63	51	43	38.5	37	36.5
WFE - 66743 Perforated Pads B	2192	TQL	76	76	76	74	69	55	43	42	40	40
	2273	MQL	76	74	72	70	64	52	44	40	38	38
	2176	BQL	80	78	73	70	64	50	42	38	38	38
	2186	MDW	76	76	76	75	65	53	46	42	40	38
		Ave.	77	76	74	72	65.5	52.5	44	40.5	39	38.5
WFE - 66719 Slotted Pads C	2066	TQL	76	72	72	71	65	53	44	40	39	38
	1663	MQL	77	73	70	67	59	50	45	43	42	40
	2137	BQL	70	63	57	54	47	42	38	34	34	35
	2181	MDW	78	74	70	67	59	48	41	38	36	36
		Ave.	75	70.5	67	65	57.5	48	42	39	38	37

Table 5. Inspection of Elberta Peaches Shipped in Bushel Baskets with Different Degrees of Ventilation Through The Pads in Fan Cars. 1/
South Carolina -1948- Test No. 3

Car	Pad	Container 2/ No.	Position in car	Total No. Fruit	Decay 3/ A 4/ %	Decay 3/ B 4/ %	Slight bruise A 4/ %	Damage A 4/ %	Damage B 4/ %	Severe damage A 4/ %	Severe damage B 4/ %	Ripeness 5/ A 4/	Ripeness 5/ B 4/
A FGE 38512	Std. (Non-vented)	1	TQL CL	162	0	4.3	5.6	1.9	4.9	0	0.6	F -(FR)	R
		2	TQL CL	162	1.9	3.1	6.8	3.1	3.7	1.9	3.7	F -FR	FR - R
		3	BQL CL	149	0	.7	7.4	4.7	5.4	4.7	4.7	F -(R)	R
		4	BQL CL	160	0	1.9	6.9	2.5	11.2	.6	2.5	F	-
B WFE 66743	Pefor-ated	1	TQL CL	167	1.2	6.6	3.0	6.6	4.2	5.4	1.8	FR - R	FR-R
		2	TQL CL	171	0	7.0	7.0	4.1	2.3	2.3	1.8	F - FR	FR-R
		3	BQL CL	170	0	1.2	5.9	3.5	5.9	2.3	4.7	F - FR	FR-R
		4	BQL CL	157	0	6.3	10.8	13.4	9.5	6.4	5.1	F - FR	R
C WFE 66719	Slotted	1	TQL CL	170	0	3.0	5.9	3.5	10.0	1.2	.6	F - FR	R
		2	TQL CL	163	.6	4.9	7.4	4.3	7.6	1.2	2.5	F - FR	-
		3	BQL CL	-	-	-	-	-	-	-	-	-	-
		4	BQL CL	163	0	5.0	6.7	1.8	3.7	3.1	0	F - FR	FR-R

1/ Loaded at Inman, S. C. on 7/28/48. Car A at 2:00-3:00 P.M., Car B at 10:30-11:30 A.M. and Car C at 1:00-2:00 P.M.
2/ Standard export tub bushel basket. For description of pads see text page 2 and figures 2 and 3.
3/ Both brown rot and Rhizopus (62% Rhizopus, 38% brown rot).
4/ A = Arrival inspection on August 1. B = Final inspection on August 6.
5/ F = Firm, FR = Firm ripe and R = Ripe.

Figure 1. Extended stave basket and lid.

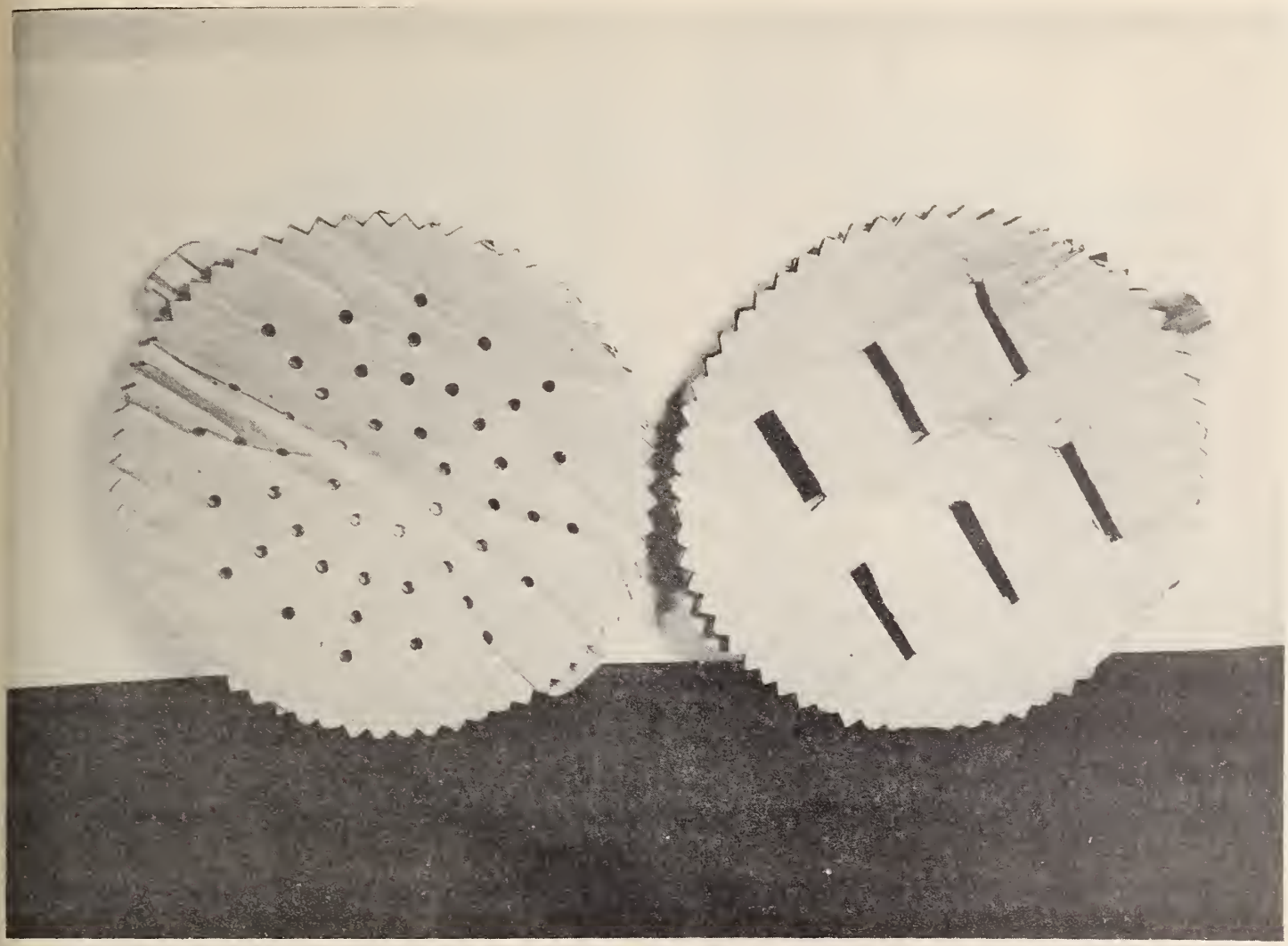

Figure 2. Types of vented pads used in test shipments. Perforated pad on left and slotted pad on right.

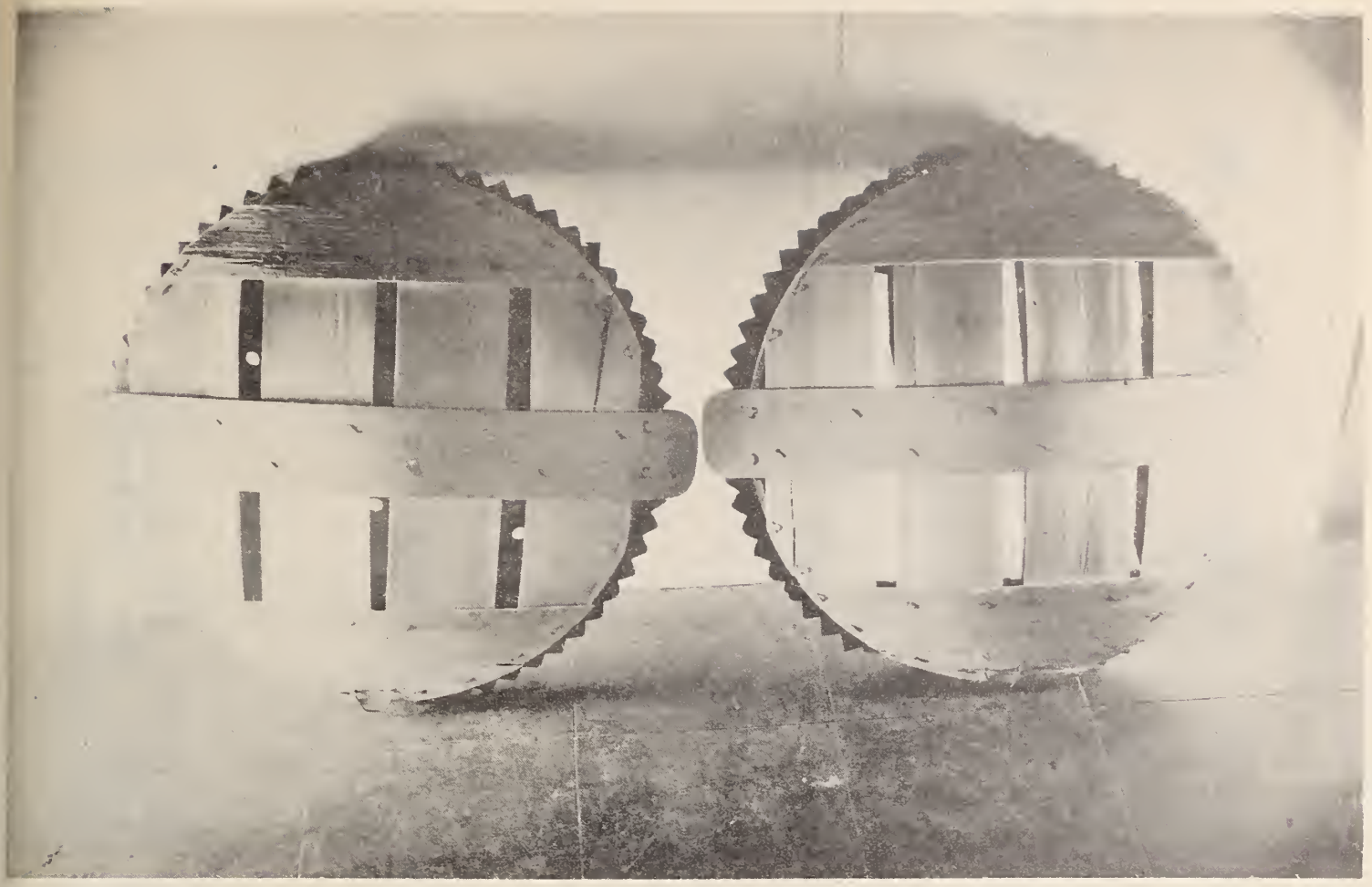

Figure 3. Basket lids with vented pads attached showing extent of ventilation obtained with perforated pad (left) and slotted pad (right).

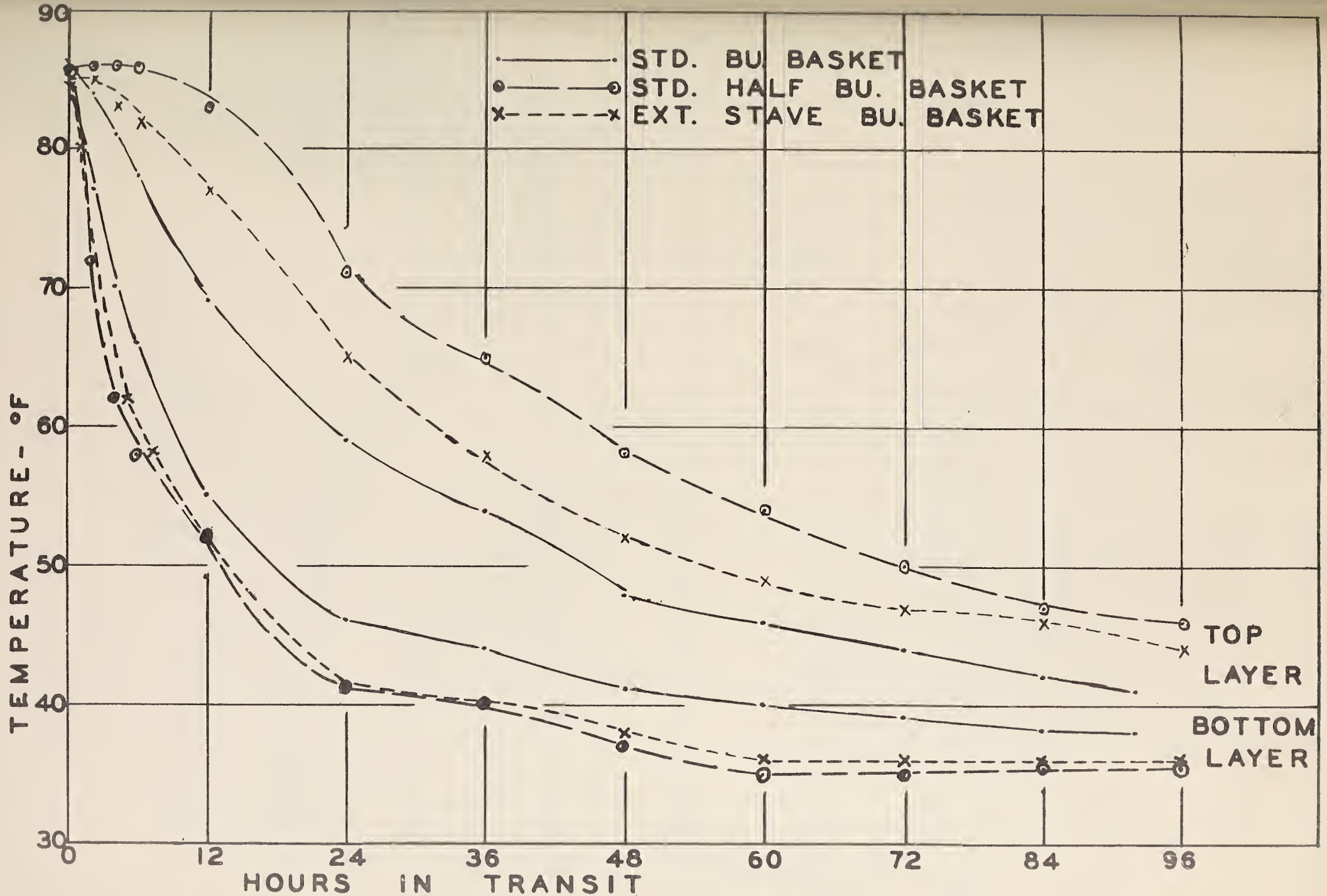

Figure 4. Cooling of Peaches in Different Type Containers.
Shipment from Gramling S.C. on July 21.

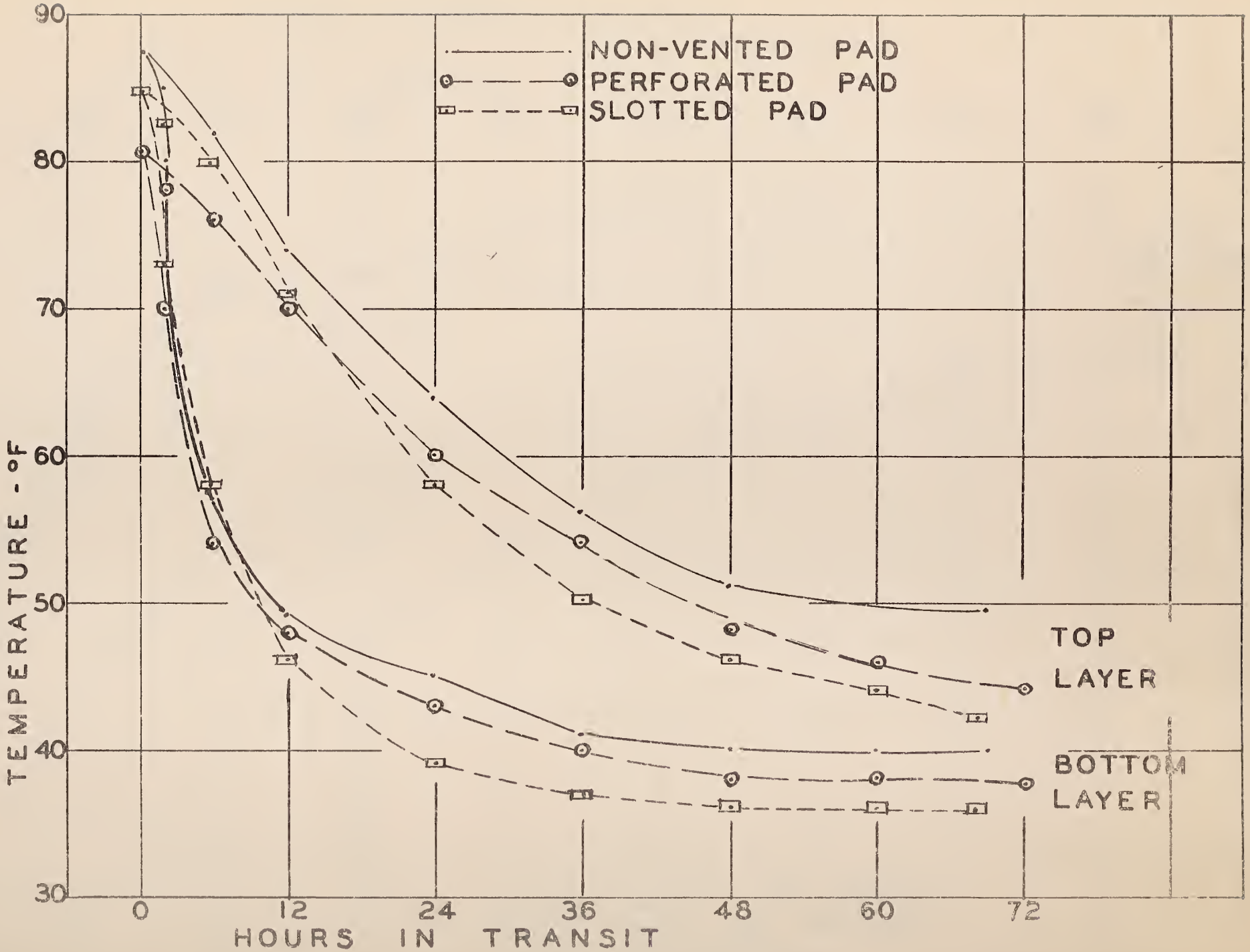

Figure 5. Cooling of Peaches in Relation to Ventilation Through Pads. Shipment from Inman, S. C. on July 27 in non-fan cars.

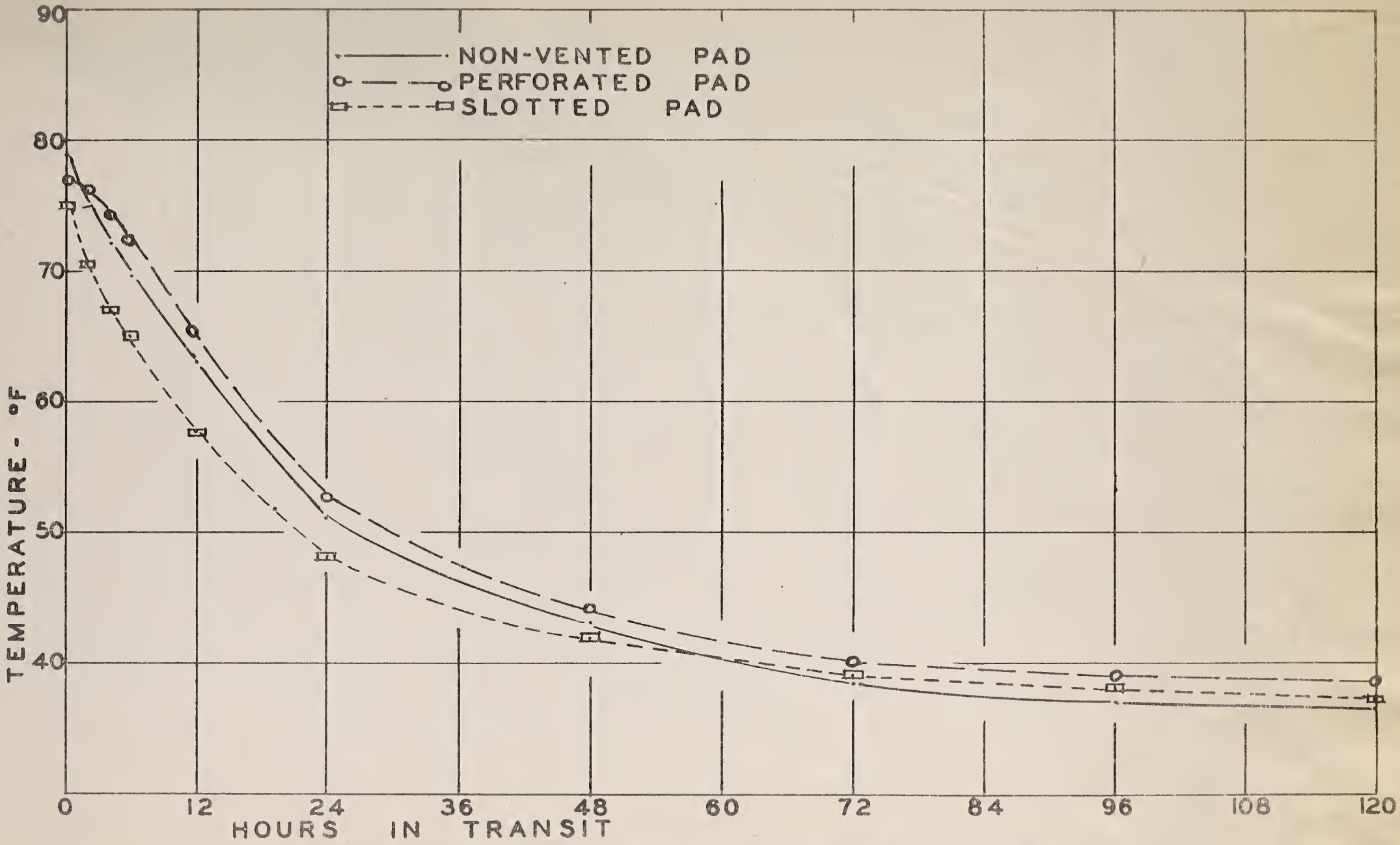

Figure 6. Cooling of Peaches in Relation to Ventilation Through Pads. Shipment from Inman, S. C. on July 29 in Fan Cars.